

Oregon Coast Coho Salmon Recovery Plan Summary



Introduction

Oregon Coast coho salmon (*Oncorhynchus kisutch*) are protected under the Endangered Species Act (ESA). The fish spawn and rear in rivers, streams, and lakes along Oregon's coastline, from the Necanicum River near Seaside on the north to the Sixes River near Port Orford on the south (Figure S-1). NOAA's National Marine Fisheries Service (NMFS) first listed Oregon Coast coho salmon as a threatened species under the ESA in 1998. NMFS relisted the species in 2008 and reaffirmed the listing in 2011.

This recovery plan (Plan) provides guidance to improve the viability of the species to the point that it meets the delisting criteria and no longer requires ESA protection. Under ESA direction, we need to resolve threats to the species and ensure the long-term persistence of naturally self-sustaining populations in the wild.

Recovery direction for Oregon Coast coho salmon has one central overriding theme: to protect and restore the freshwater and estuarine rearing habitats that support juvenile survival and overall productivity.

The Plan builds on past and current efforts to restore the coho salmon. In particular, this plan calls for continued actions to repair the ecosystem processes that influence the health and stability of the rearing habitats for juvenile coho salmon. The actions will also benefit many other fish and wildlife species, and could provide aid to land owners and local communities

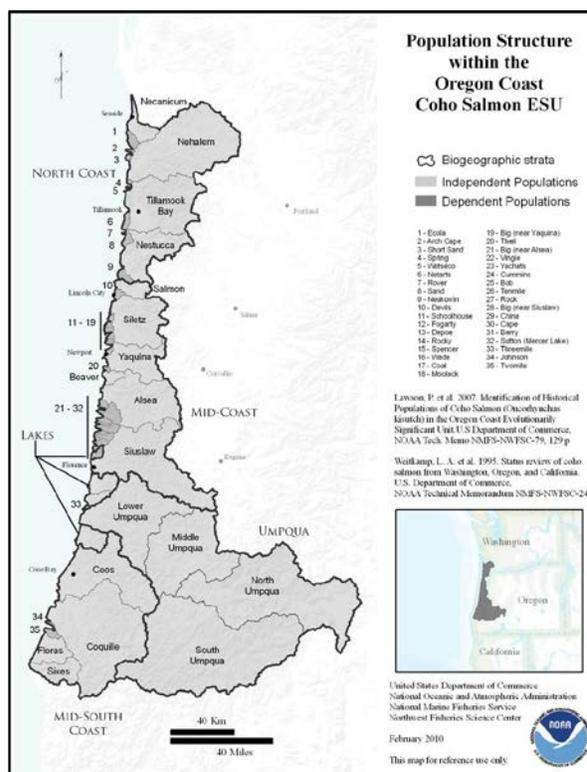


Figure S-1. Map of Oregon Coast Coho Salmon ESU, populations and strata (larger population groupings).

Perspective: Past and Current Coho Salmon Runs

During the 1800s and early 1900s, strong runs of coho salmon returned each year to rivers and lakes along the Oregon coast. State and federal scientists estimate that one to two million adult coho salmon returned during periods of favorable ocean conditions, often creating concentrations of several hundred spawners per mile in coastal rivers. These mighty runs supported commercial and recreational fisheries, and helped anchor local economies up and down the coast, but began to decline in the mid-1900s and the total number of returning native coho salmon dropped to below 14,600 fish in 1983. The native coho salmon runs then improved for a few years before declining again to near 21,000 fish in 1990 and to below 24,000 fish in 1997 (See Figure S–2). The decline led NMFS to list the fish under the ESA in 1998; attributing the species’ decline to multiple factors: high harvest rates, high hatchery production, significantly degraded habitat, and periods of poor ocean conditions.

Today, thanks largely to improvements made by multiple parties over the last twenty years, more native coho salmon return to the Oregon Coast than at the time of listing — though annual returns fluctuate greatly with variable ocean conditions. Recent native coho salmon returns hit modern-era highs of over 350,000 spawners in 2011 and 2014, but slumped to lows of 99,000 spawners in 2012 and, most recently, to 57,000 spawners in 2015 (ODFW 2016). These sharp fluctuations indicate that positive Oregon Coast coho salmon abundance trends are tied largely to favorable marine survival, which can change quickly, creating uncertainty about whether recent levels of abundance can be retained, especially since recent projections by NMFS’ Northwest Fisheries Science Center (NWFS) indicate that a new period of poor ocean conditions is possible, which could result in reduced ocean survival rates and decreased sustainability. This suggests that more actions are needed to ensure the species is sustainable and no longer needs ESA protection.

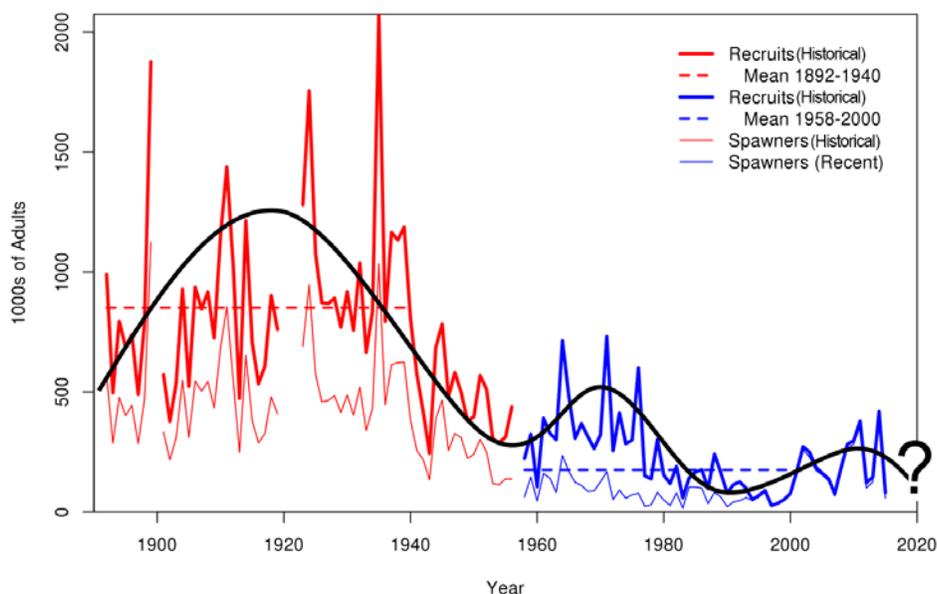


Figure S-2. Comparison of historical (1892–1956) and recent (1958–2015) estimates of spawner abundance and pre-harvest recruits. Horizontal dotted lines are the geometric mean recruits for 1892–1940 and 1960–2009. Analysis based on data from Cleaver 1951, Mullen 1981a, and Mullen 1981b; recent data from Wainwright et al. 2008 and ODFW 2016. Dark line is one interpretation of the long-term trend.

Oregon Coast Coho Salmon and Habitat

What is an evolutionarily significant unit (ESU)?

An ESU is a group of Pacific salmon that is (1) substantially reproductively isolated from other groups of the same species and (2) represents an important component of the evolutionary legacy of the species. ESUs are defined based on geographic range as well as genetic, behavioral and other traits.

Pacific coho salmon (*Oncorhynchus kisutch*) are a wide-ranging species that spawns in rivers and rear in streams and estuaries around the Pacific Rim from Monterey Bay in California north through the Aleutian Islands to Point Hope, Alaska; and from the Anadyr River in Russia south to Korea and northern Hokkaido, Japan.

The Oregon Coast coho salmon evolutionarily significant unit (ESU) includes the Pacific Ocean and the freshwater and estuarine habitat (rivers, streams and lakes) along the Oregon Coast from the Necanicum River on the north to the Sixes River on the south. Rivers in the ESU flow from the mountains of the Coast Range, with the exception of

the Umpqua River, which extends east through the Coast Range to drain the Cascade Mountains. Most of the rivers transition to estuaries before reaching the Pacific Ocean.

Oregon Coast Coho Salmon Life Cycle

The anadromous life cycle for coho salmon begins in their home stream, normally a small tributary with moderate to low gradient stream reaches. After emerging from the gravel, the small fish seek cool, slow moving stream reaches with quiet areas such as backwater pools, beaver ponds, and side channels. Juveniles generally spend one summer and a winter in these rearing areas before migrating towards the ocean as smolts in the spring, typically from late April until early June.

Migration strategies are an important feature of life history diversity. Coho salmon smolts may be present in estuaries for a period of weeks to a month or more during their migration to the ocean.

They seek out low-salinity gradients during their stay in the estuaries where they can grow and slowly acclimate to saltwater. They also reside in shallow areas, side channels, and plumes of freshwater extending offshore at varying times of the year.

Most adult coho salmon return to natal tributaries from September to November as 3-year-old fish, after spending two summers in the ocean (Figure S-3). The early ocean life is believed to be a critical time for the fish since significant marine mortality can occur during the first two weeks to months of ocean life.

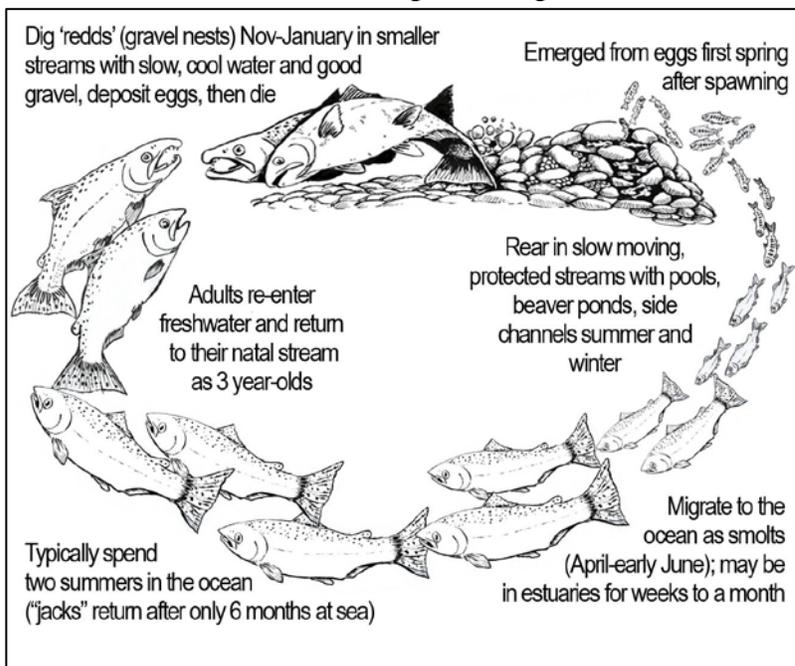


Figure S-3. Oregon Coast coho salmon life cycle.

Endangered Species Act Requirements

The ESA requires NMFS to develop and implement plans for the conservation and survival of species listed as endangered or threatened under the ESA. This Plan provides the required information. It describes (1) measurable criteria which, when met, will result in a determination that the species be removed from the list; (2) site-specific management as may be necessary to achieve the Plan's goal for conservation and survival of the species; and (3) estimates of the time required and cost to carry out the actions. It also describes threats and factors that affect the species.

Scientific Foundation of Recovery Plan

The recovery plan is based on the best available science about the Oregon Coast coho salmon ESU. It builds on the work of the Oregon/ Northern California Coasts Technical Recovery Team, a team of scientists from NMFS, states, tribes, and academic institutions. The team identified the historical populations comprising the species, as well as the larger groupings 'strata' that combine populations with geographic and genetic similarities within the ESU (See Figure S-1).

The team also recommended biological recovery criteria that evaluate two general conditions that imply different levels of risk: Persistence, the ability of the ESU to persist over a 100-year period without artificial support; and Sustainability, the ability of the ESU to maintain its genetic legacy and long-term adaptive potential for the foreseeable future. The criteria were used to evaluate six measures of population, stratum and ESU health: spawner abundance, spawner distribution, juvenile distribution, critical abundance, population productivity, and artificial influence.

Recovery Goals and Delisting Criteria

The Plan (Chapter 4) provides recovery goals and criteria that NMFS will use in future reviews of the status of the Oregon Coast coho salmon ESU.

ESA Recovery Goal: Our primary goal is that the ecosystems upon which Oregon Coast coho salmon depend are conserved such that the ESU is sustainable and persistent and no longer needs federal protection under the ESA.

Delisting Criteria: In the simplest terms, NMFS will remove the ESU from ESA listing when we determine that:

- The species has achieved a biological status consistent with recovery — the best available information indicates it has sufficient abundance, population growth rate, population spatial structure, and diversity to meet its biological recovery goal.
- Factors that led to ESA listing (described in Chapter 3) have been reduced or eliminated to the point where federal protection under the ESA is no longer needed, and there is reasonable certainty that the relevant regulatory mechanisms are adequate to protect Oregon Coast coho salmon sustainability.

The biological recovery criteria include two principle elements for ESA recovery:

- Most of the independent populations have to be sustainable in each stratum.
- All five strata have to be sustainable for the whole ESU to be sustainable.

Threats and Limiting Factors Analysis

Federal and state scientists used a substantial body of technical research and data about Oregon Coast coho salmon to identify threats and limiting factors that have hindered the species' ability to be naturally self-sustaining. This section summarizes findings discussed in Chapter 3 regarding key factors that led to the species' decline and continue to affect it today.

Factors Leading to ESA Listing

In 1998, NMFS determined that many human activities had contributed to the decline of the ESU to threatened status: "For coho salmon populations in Oregon, the present depressed condition is the result of several longstanding, human-induced factors (e.g., habitat degradation, water diversions, harvest, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and poor ocean conditions." Subsequent status reviews found that risks posed by hatchery fish and fisheries had been greatly remedied, however, continued uncertainty remained about the ESU's long-term status due to persisting threats from habitat degradation and climate change that were predicted to degrade in the future (NMFS 1998; Good et al. 2005; Stout et al. 2012).

Factors Affecting ESU Status Today

Today, Oregon Coast coho salmon are primarily affected by threats that reduce the quantity and quality of coho salmon rearing habitat. Reviews by NMFS' biological review teams in 2011 and 2015 found that the long-term decline in Oregon Coast coho salmon productivity reflected deteriorating conditions in freshwater habitat, and that the remaining habitat may not be high enough to sustain the species productivity during cycles of poor ocean conditions (NWFSC 2015; Stout et al. 2012).

Primary Limiting Factors:

1. **Reduced amount and complexity of habitat.** Loss of stream complexity, including connected floodplain habitat, is a primary limiting factor for many coho salmon populations and overwinter rearing of juvenile coho salmon is especially a concern. This instream habitat is critical to produce high enough juvenile survival to sustain productivity, particularly during periods of poor ocean conditions.

Habitat conditions that create sufficient complexity for juvenile rearing and overwintering include large wood debris structures, pools, connections to side channels and off-channel

What are threats and limiting factors?

Threats are human activities or natural events, such as floodplain development or drought, which cause or contribute to limiting factors.

The term 'threats' carries a negative connotation, but they are often legitimate and necessary human activities that at times may have unintended negative consequences on fish. The activities can be managed to minimize or eliminate the negative impacts.

Limiting factors are biological and physical conditions and related ecological processes and interactions that limit a species' viability. Primary limiting factors have the greatest impacts on a population's ability to reach the desired status. Stresses, a term used in a common framework approach to ecosystem management, are ecological attributes that have been altered and limit a species' viability.



alcoves, beaver ponds, lakes, and connections to wetlands, backwater areas and complex floodplains. Many of these habitat conditions are maintained through connection to the surrounding landscape. Beaver provide considerable help in providing this connection and in maintaining proper watershed functioning in Oregon coast streams.

2. **Degraded water quality.** Reduced water quality, including high water temperatures and increased fine sediment levels affect coho salmon production in several populations. Increased water temperature is the primary source of water quality impairment for Oregon Coast coho salmon, and rising water temperatures due to climate change could add to this problem. Land use activities have contributed to increased water temperatures in coastal streams by removing riparian vegetation, disconnecting streams from floodplains, and reducing streamflow through water diversions
3. **Blocked/impaired fish passage.** There has been extensive reduction in connectivity and access to historical estuarine and freshwater coho salmon habitats. This has been the results of two primary sources: (a) Fish passage blocked or partially blocked by culverts, tidegates, bridges, dams, dikes, and levees and (b) the loss of estuarine and tidal habitats.
4. **Uncertainty that there is an adequate combination of voluntary and regulatory mechanisms to ensure success.** Along with numerous voluntary efforts, several federal, state, and local regulatory mechanisms protect Oregon Coast coho salmon and their habitat. Currently it is unclear that the existing voluntary and regulatory mechanisms are adequate to protect habitat conditions that conserve the long-term sustainability of the species.

Coho salmon populations in coastal lake areas and some lower stream reaches are also affected by predation from introduced warm-water fishes such as smallmouth and largemouth bass, and in some cases from birds and marine mammals. Concerns posed by summer water temperatures and predation may increase in the future due to climate change.

Table S-1. Primary ESU-level threats and limiting factors for Oregon Coast coho salmon.

Threat	Primary Limiting factors	Current level of Concern
Historical, current and future land use activities that affect watershed functions that support coho habitat	Loss of stream complexity	High
	Degraded water quality	High
	Blocked/hindered passage	High
Overharvest of OC coho salmon in ocean and freshwater tributaries	Reduced abundance and productivity due to harvest mortality	Low
Disease and increase in parasites	Reduced productivity due to increased infection	Low
Predation from birds, marine mammals and warm water fishes	Reduces coho abundance and productivity	Medium
Ineffective regulatory mechanisms	Inadequate long-term habitat protection	High
Hatchery operations and releases	Competition, predation and reduced diversity	Low
Changes in ocean conditions	Reduced fitness and survival, thereby abundance and productivity	High
Climate change	Further habitat degradation and thereby productivity	Medium- High

Recovery Strategy — Conservation Partnerships

Our recovery strategy for Oregon Coast coho salmon focuses on restoring and conserving the ecosystems upon which the species depend so the ESU is naturally self-sustaining and persistent in the wild and no longer needs federal protection under the ESA. We will also continue to participate with partners to ensure that fisheries and hatcheries are managed to protect Oregon Coast coho salmon.

Since ESA listing, the status of Oregon Coast coho salmon has improved. The most recent status review update of the ESU (NWFSC 2015) determined that there is a moderate certainty that the ESU is now sustainable. Nevertheless, it is NMFS' opinion that the current strengthened status of the Oregon Coast coho salmon populations is primarily due to a combination of reduced harvest and hatchery production and high marine survival. Based on the best available science, we remain concerned that the current quality (especially temperature) and quantity of freshwater habitats leaves the ESU at risk of becoming an endangered species, particularly if global climate change leads to a long-term downward trend in freshwater and marine coho salmon habitat compared to current conditions. Thus, we recommend that efforts continue to protect and restore freshwater and estuarine habitat.

The Plan (Chapter 6) provides a suggested roadmap to address remaining threats to the species' viability. It describes alternate routes (strategies and actions) to get to recovery, but also calls for refinement of actions through collaboration because there is no one 'right' way to get success. In particular, the strategy promotes the creation of partnerships that integrate the needs of coho salmon with the needs of local communities and stakeholders. We intend to support partnerships with landowners, businesses, non-governmental and governmental entities, and others to shape practicable solutions that fit the long-term recovery of the species while also supporting sustainable communities in coastal Oregon and meeting the needs of local residents. For more than twenty years, voluntary actions by state, federal, and local organizations and individuals have been improving habitat access and conditions in many areas. The Plan builds upon and complement these efforts.

NMFS' overall recovery direction for Oregon Coast coho salmon centers on restoring degraded habitats and the ecosystem processes and functions that affect those habitats, and protecting habitats that are currently functioning through an effective combination of voluntary and regulatory programs. The primary focus is to protect and restore freshwater and estuarine rearing habitats upon which egg-to-smolt survival, and overall productivity, depends. We also recommend continued, and enhanced, monitoring (as resources are available) to gain critical information about the factors that affect the fish, or may affect the fish given climate change, and to quantify net changes in key habitat features in response to implemented actions.

Strategies to Improve Habitat — Developing Scientifically Sound, Coordinated Approaches

Coho salmon recovery demands the application of well-formulated, scientifically sound approaches. The Plan identifies several key steps to improve and protect habitats:

1. **Restore watershed and estuarine processes to increase rearing habitat quality and capacity.**
Natural watershed-level and reach-level physical and biological processes form the habitat features that salmon need. The habitat strategy promotes actions that address the root

causes of ecosystem impairment, such as by re-establishing floodplain connectivity. High quality overwintering habitat for juvenile fish is almost always found in areas where the stream is low gradient and connected with its floodplains. This habitat shelters the fish from high velocity flows and usually contains one or more of the following features: connected floodplains and wetlands with attached off-channel alcoves, beaver dams and ponds, lakes, and channels with large wood and debris and deep pools. High quality summer-rearing habitat contains many of the same features as winter rearing habitat, but foremost provides refuge from high summer water temperatures. (See Figure S-4.)

2. **Ensure long-term ecosystem functions and high quality habitat by reducing habitat-related threats and encouraging formation of beaver dams and beaver dam analogues.**

High quality juvenile rearing habitat for coho salmon is a reflection of stream and estuarine complexity, which is shaped by several combined watershed processes that influence hydrologic, sediment, riparian, channel, biological, floodplain and estuarine habitat functions. NMFS supports using a collaborative process to enhance the effectiveness of voluntary programs and ensure that regulatory backstop mechanisms and other approaches are in place to protect natural watershed-scale and reach-scale physical and biological processes and functions, such as the re-establishment of connected floodplain habitats.

3. **Improve and recover the species through a common framework and innovative partnerships.**

NMFS aims to strengthen partnerships with governmental and nongovernmental organizations, landowners, and others to encourage collaboration toward recovery and conservation of Oregon Coast coho salmon populations. We recommend a common framework used in population level plans to provide an integrated, strategic approach that directs and coordinates voluntary efforts to improve key watershed processes and habitats so they effectively support recovery goals for individual coho salmon populations and ESU.

4. **Implement an adaptive management process to track progress toward recovery, monitor and evaluate key information needs, assess results, and refine strategies and actions accordingly.**

Adaptive management plays a key role in the recovery strategy for Oregon Coast coho salmon. The strategy requires a process to track progress, define uncertainties and weaknesses, and adjust our course appropriately. Our strategy includes collaborations to develop a step-by-step approach to define watershed- or population-level strategies and actions that will integrate the best available science.

Management Actions

Several site-specific management actions are generally applicable to restore degraded habitats and the ecosystem processes and functions that support those habitats across the ESU.

Voluntary actions. Protection and restoration of salmon habitat will only be accomplished if the people who call the area home make that a priority. We encourage and support conservation work by private landowners, local groups, and others to improve ecological processes and habitats, particularly in areas with the greatest potential to create high quality coho salmon rearing habitat.

Regulatory actions. An important element in our plan is to integrate voluntary and regulatory efforts to address indirect threats — the roots causes of ecosystem impairment. We need to be confident that regulatory backstops ensure compliance with adequate laws and regulations to provide habitat conditions that can support a sustainable ESU.

Research, monitoring and evaluation actions. Continuing the effective research, monitoring and evaluation efforts will be critical to success. In particular, we will continue to work with partners to develop the most cost-effective means to monitor the status and trends of habitat conditions.

In summary, NMFS’ recovery direction for Oregon Coast coho salmon focuses on turning degraded habitat into good habitat, and protecting habitats that are currently functioning. As illustrated in Figure S-4, improving bad salmon habitat centers on restoring the ecosystem processes and functions that affect those habitats.



Figure S-4. Examples of bad and good freshwater rearing habitat for Oregon Coast coho salmon.

Implementation

Ultimately, recovery of Oregon Coast coho salmon depends on the commitment and dedicated actions of the many individuals and entities who share responsibility for the stewardship of the species' future, and NMFS looks forward to partnering with them in a collaborative effort. The recovery of Oregon Coast coho salmon will depend on the collaboration of partners at the regional, state, ESU, population, and watershed levels.

Chapter 8 proposes an integrated public-private implementation approach to achieve Oregon Coast coho salmon recovery. As discussed earlier, we need to restore and protect freshwater habitats to improve the overall status of the species in the face of anticipated future reductions in marine survival associated with climate change. Accomplishing this goal can be accomplished through a combination of successful locally supported voluntary programs, with regulatory backstops. Supporting partnerships among stakeholders can help shape practicable solutions that fit the long-term recovery of the species while also supporting sustainable communities in coastal Oregon.

NMFS encourages efforts to enhance voluntary conservation programs, create new innovative voluntary incentive programs, and improve the effectiveness of existing regulatory programs. Together, such programs would help halt the net loss of juvenile coho salmon rearing habitat and create additional juvenile rearing habitat.



Photo courtesy of Lower Columbia River Estuary Partnership.

We will continue to work with agencies, tribes, and local stakeholders to implement coordinated and collaborative programs and projects. In particular, the Plan anticipates the development of the Coho Business Plan (a public-private partnership described in Chapter 8) and population-level Strategic Action Plans, which will serve as a nexus between federal, state and local efforts. We will also actively partner with Oregon to integrate implementation of this recovery plan with related state efforts, and work to align federal programs that provide technical and financial assistance and regulatory assurances to private landowners where possible.

Time and Cost Estimates

NMFS estimates that if the strategies and actions identified in this Plan are implemented in a timely manner, and marine survival is not too low, we will be able to delist Oregon Coast coho salmon within the next 10 years. However, we recognize that the time needed to recover the species under the ESA depends on near-term conditions (marine and freshwater), the types of actions and rate of implementation, and how effectively the actions address remaining limiting factors and threats.

Based on current expenditure levels, NMFS estimates the cost of recovery for the next five and ten years to be approximately \$55 million and at approximately \$110 million to achieve recovery. This depends greatly on the ability to target habitat restoration activities to areas where the greatest gains can be made in improving winter and summer rearing habitats, and on success in providing the regulatory backstops to protect coho salmon habitat over the long term. Chapter 7 discusses our time and cost estimates.